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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/620,702	07/17/2003	Zhaohui Cheng	501.42786X00	5935

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EXAMINER

PATEL, PARESH H

ART UNIT	PAPER NUMBER
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2829

DATE MAILED: 10/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/620,702

Applicant(s)

CHENG ET AL.

Examiner

Paresh Patel

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED/STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 07/03.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: --Inspection method and apparatus for circuit pattern of resist material--.

The disclosure is objected to because of the following informalities: at line 16 of page 20, "11" should read --22--.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-12 are rejected under 35 U.S.C. 102(a) as being anticipated by Nasu et al. (US 2004/0051040 A1 or PCT/JP02/02983 or JP 2001-259126).

Regarding claim 1, Nasu et al. (hereafter Nasu) in embodiment 1, discloses a method of inspecting a board [9] with a circuit pattern [photoresist pattern] including at

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least a porous low-permittivity material or a material similar to it in terms of structure or composition [ArF resist], comprising the steps of:

scanning [using SEM of fig. 1] the circuit pattern [the pattern on surface of 9, paragraph 0045 and Embodiment 1 at paragraph 0058] with a primary electron beam [4];

detecting secondary electrons [first three lines of paragraph 0046] generated or electrons reflected from the board [9] due to the irradiation or both the former and latter electrons and converting the electrons into signals [lines 3-6 of paragraph 0046];

transforming the signals into an image [lines 6-8 of paragraph 0046], displaying the image, and inspecting circuit pattern [on 26]; and

reducing damage including shrinkage to the circuit pattern by a primary electron beam by controlling the irradiation energy and density of the primary electron beam [paragraph 0060].

Regarding claim 2, Nasu discloses the areas of the circuit pattern to be exposed to the primary electron beam include at least a porous low-permittivity hydrogensilsesquioxane material or a material similar (see last paragraph of specification on page 34) to it in terms of structure or composition [ArF photoresist of paragraph 0059].

Regarding claim 3, Nasu discloses the shrinkage of the circuit pattern due to the exposure to the primary electron beam is reduced to 2.4nm or less by setting the irradiation energy of the primary electron beam to 300 ev or less [paragraph 0075-0077].

Regarding claim 4, Nasu discloses the irradiation density of the primal electron beam is limited according to the irradiation energy of the primary electron beam and depending on the kind of said low-permittivity material or similar material [paragraph 0065].

Regarding claim 5, Nasu discloses a step of recording [using 30 and paragraph 0047] the irradiation history of the board such as the irradiation energy, probe current, and irradiation density of the primary electron beam and the areas of the circuit pattern to be exposed to the primary electron beam.

Regarding claim 6, Nasu discloses finding, in advance, for each material included in the board, the correlations between (i) parameters including the irradiation energy, probe current, and irradiation density of the primary electron beam and (ii) dimensional changes of the circuit pattern; and

adjusting at least one of the parameters before the circuit pattern is scanned with the primary electron beam [paragraph 0054-0057].

Regarding claim 7, Nasu discloses the irradiation density of the primary electron beam is controlled by (i) calculating, in advance, the maximum dose of irradiation per unit area in each area of the circuit pattern to be exposed to the primary electron beam and (ii) limiting the irradiation density of the primary electron beam below the maximum dose of irradiation in said area during the inspection of the board [using equation 1, see paragraph 0059-0062].

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Regarding claim 8, Nasu discloses a method of inspecting a board with a circuit pattern including at least a porous low-permittivity material or a material similar to it in terms of structure or composition, comprising the steps of:

scanning [using SEM] the circuit pattern with a primary electron beam;

detecting secondary electrons [see paragraph 0046] generated or electrons reflected from the board due to the irradiation or both the former and latter electrons and converting the electrons into signals;

transforming the signals [see paragraph 0046] into an image, displaying the image, and inspecting the circuit pattern; and

reducing the shrinkage of the circuit pattern due to the exposure to the primary electron beam to 2.4 nm or less by setting the irradiation energy of the primary electron beam to 300 ev or less [see paragraph 0075-0077].

Regarding claim 9, Nasu discloses at least the areas of the circuit pattern to be exposed to the primary electron beam include at least a porous low-permittivity hydrogensilsesquioxane material or a material [ArF photoresist of paragraph 0059] similar to it in terms of structure or composition.

Regarding claim 10, Nasu discloses a method of inspecting a board with a circuit pattern including at least a porous low-permittivity hydrogensilsesquioxane material or a material similar to it in terms of structure or composition, comprising the steps of:

scanning [using SEM] the circuit pattern with a primary electron beam;

detecting [see paragraph 0046] the secondary electrons generated or the electrons reflected from the board due to the irradiation or both the former and latter electrons and converting the electrons into signals;

transforming the signals into an image [see paragraph 0046], displaying the image, and inspecting circuit pattern; and

reducing the shrinkage of the circuit pattern due to the exposure to the primary electron beam to 2.4 nm or less by (i) setting the irradiation energy of the primary electron beam to 300 ev or less [see paragraph 0075-0077] or (ii) setting the irradiation density of the primary electron beam to 1 .4 C/m or less if the irradiation energy of the primary electron beam is about 800 ev or more.

Regarding claim 11, Nasu in fig. 1 discloses an apparatus for inspecting a board with a circuit pattern, at least the areas of the circuit pattern to be exposed to a primary electron beam including at least a porous low-permittivity hydrogensilsesquioxane material or a material similar to it in terms of structure or composition, the apparatus comprising:

a means [SEM of fig. 1] for scanning the circuit pattern with the primary electron beam;

a means for detecting secondary electrons generated or electrons reflected [12, 28, from the board due to the irradiation or both the former and latter electrons and converting the electrons into signals; and

a means for transforming the signals into an image [paragraph 0046], displaying the image on 26 with 30], and inspecting circuit pattern, damage including shrinkage to

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the circuit pattern by the primary electron beam being reduced by controlling the irradiation energy and density of the primary electron beam.

Regarding claim 12, Nasu discloses the shrinkage of the circuit pattern due to the exposure to the primary electron beam is reduced to 2.4 nm or less by setting the irradiation energy of the primary electron beam to 300 eV or less [see paragraph 0075-0077].

Claims 1-12 are rejected under 35 U.S.C. 102(e) as being anticipated by Nasu et al. (US 2004/0051040 A1).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Regarding claim 1, Nasu et al. (hereafter Nasu) in embodiment 1, discloses a method of inspecting a board [9] with a circuit pattern [photoresist pattern] including at least a porous low-permittivity material or a material similar to it in terms of structure or composition [ArF resist], comprising the steps of:

scanning [using SEM of fig. 1] the circuit pattern [the pattern on surface of 9, paragraph 0045 and Embodiment 1 at paragraph 0058] with a primary electron beam [4];

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detecting secondary electrons [first three lines of paragraph 0046] generated or electrons reflected from the board [9] due to the irradiation or both the former and latter electrons and converting the electrons into signals [lines 3-6 of paragraph 0046];

transforming the signals into an image [lines 6-8 of paragraph 0046], displaying the image, and inspecting circuit pattern [on 26]; and

reducing damage including shrinkage to the circuit pattern by a primary electron beam by controlling the irradiation energy and density of the primary electron beam [paragraph 0060].

Regarding claim 2, Nasu discloses the areas of the circuit pattern to be exposed to the primary electron beam include at least a porous low-permittivity hydrogensilsesquioxane material or a material similar (see last paragraph of specification on page 34) to it in terms of structure or composition [ArF photoresist of paragraph 0059].

Regarding claim 3, Nasu discloses the shrinkage of the circuit pattern due to the exposure to the primary electron beam is reduced to 2.4nm or less by setting the irradiation energy of the primary electron beam to 300 ev or less [paragraph 0075-0077].

Regarding claim 4, Nasu discloses the irradiation density of the primal electron beam is limited according to the irradiation energy of the primary electron beam and depending on the kind of said low-permittivity material or similar material [paragraph 0065].

Regarding claim 5, Nasu discloses a step of recording [using 30 and paragraph 0047] the irradiation history of the board such as the irradiation energy, probe current, and irradiation density of the primary electron beam and the areas of the circuit pattern to be exposed to the primary electron beam.

Regarding claim 6, Nasu discloses finding, in advance, for each material included in the board, the correlations between (i) parameters including the irradiation energy, probe current, and irradiation density of the primary electron beam and (ii) dimensional changes of the circuit pattern; and

adjusting at least one of the parameters before the circuit pattern is scanned with the primary electron beam [paragraph 0054-0057].

Regarding claim 7, Nasu discloses the irradiation density of the primary electron beam is controlled by (i) calculating, in advance, the maximum dose of irradiation per unit area in each area of the circuit pattern to be exposed to the primary electron beam and (ii) limiting the irradiation density of the primary electron beam below the maximum dose of irradiation in said area during the inspection of the board [using equation 1, see paragraph 0059-0062].

Regarding claim 8, Nasu discloses a method of inspecting a board with a circuit pattern including at least a porous low-permittivity material or a material similar to it in terms of structure or composition, comprising the steps of:

scanning [using SEM] the circuit pattern with a primary electron beam;

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detecting secondary electrons [see paragraph 0046] generated or electrons reflected from the board due to the irradiation or both the former and latter electrons and converting the electrons into signals;

transforming the signals [see paragraph 0046] into an image, displaying the image, and inspecting the circuit pattern; and

reducing the shrinkage of the circuit pattern due to the exposure to the primary electron beam to 2.4 nm or less by setting the irradiation energy of the primary electron beam to 300 ev or less [see paragraph 0075-0077].

Regarding claim 9, Nasu discloses at least the areas of the circuit pattern to be exposed to the primary electron beam include at least a porous low-permittivity hydrogensilsesquioxane material or a material [ArF photoresist of paragraph 0059] similar to it in terms of structure or composition.

Regarding claim 10, Nasu discloses a method of inspecting a board with a circuit pattern including at least a porous low-permittivity hydrogensilsesquioxane material or a material similar to it in terms of structure or composition, comprising the steps of:

scanning [using SEM] the circuit pattern with a primary electron beam;

detecting [see paragraph 0046] the secondary electrons generated or the electrons reflected from the board due to the irradiation or both the former and latter electrons and converting the electrons into signals;

transforming the signals into an image [see paragraph 0046], displaying the image, and inspecting circuit pattern; and

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reducing the shrinkage of the circuit pattern due to the exposure to the primary electron beam to 2.4 nm or less by (i) setting the irradiation energy of the primary electron beam to 300 ev or less [see paragraph 0075-0077] or (ii) setting the irradiation density of the primary electron beam to 1 .4 C/m or less if the irradiation energy of the primary electron beam is about 800 ev or more.

Regarding claim 11, Nasu in fig. 1 discloses an apparatus for inspecting a board with a circuit pattern, at least the areas of the circuit pattern to be exposed to a primary electron beam including at least a porous low-permittivity hydrogensilsesquioxane material or a material similar to it in terms of structure or composition, the apparatus comprising:

a means [SEM of fig. 1] for scanning the circuit pattern with the primary electron beam;

a means for detecting secondary electrons generated or electrons reflected [12, 28, from the board due to the irradiation or both the former and latter electrons and converting the electrons into signals; and

a means for transforming the signals into an image [paragraph 0046], displaying the image on 26 with 30], and inspecting circuit pattern, damage including shrinkage to the circuit pattern by the primary electron beam being reduced by controlling the irradiation energy and density of the primary electron beam.

Regarding claim 12, Nasu discloses the shrinkage of the circuit pattern due to the exposure to the primary electron beam is reduced to 2.4 nm or less by setting the

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irradiation energy of the primary electron beam to 300 eV or less [see paragraph 0075-0077].

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Paresh Patel whose telephone number is 571-272-1968. The examiner can normally be reached on 8:00 to 4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Tokar can be reached on 571-272-1812. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Paresh Patel
October 15, 2004

